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MICROSCOPE, ESPECIALLY MICROSCOPE USED FOR INSPECTION IN SEMICONDUCTOR MANUFACTURE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority of International Application No. PCT/EP00/09199, filed September 20, 2000 and German Application No. 199 46 594.0, filed September 29, 1999, the complete disclosures of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The invention is directed to the coupling of pulsed laser radiation into a microscope, especially a microscope used for the quality control and classification of defects of masks for the manufacture of semiconductors.

SUMMARY OF THE INVENTION

In accordance with the invention, a microscope, especially for use during inspection in semiconductor manufacture comprising a pulsed laser for illumination, the laser being preferably in the UV range. The microscope includes at least one rotating diffusion disk which is arranged behind the laser for the homogenization of the illumination

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Figure 1 shows an overall diagrammatic view of an inspection device using a microscope in accordance with the invention;

Figure 2a shows a diagram of a coupling unit for coupling the laser beam into the microscope; and

Figure 2b is an additional view showing the coupling of the laser beam into the microscope.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Advantageously, a number of laser pulses are applied to the object to be examined while one image is taken. During this, intensity modulations of the laser profile of up to 40% can occur within one pulse or over a small number of pulses, which affects the evaluation.

Sub B1

Figure 1 shows an overall diagrammatic view of an inspection device consisting of a laser module LM with a pulsed UV laser, a transmitter port UP, a microscope MI with an objective O and a scanning table ST, a CCD camera KA, a screen BS and a microscope controller MC.

Figure 2a and 2b show a coupling unit UP for coupling the laser beam into the microscope MI.

The laser light reaches a first rotating diffusion disk S1 via reflecting mirrors U1, U2 and then a second rotating diffusion disk S2 preferably rotating in the opposite direction as well as the microscope ray path (not shown) via a lens for beam expansion and an aperture B and the input E in Figure 1 and illuminates the object to be examined.

The laser profile is smoothed out by means of the at least one diffusion disk.

The diffusion disk rotates at a speed which is relatively low when compared to the spacing of two laser pulses.

This means that the diffusion disk is practically not moving for the duration of a laser pulse of, for example, 10ns, but also that it moves a bit further in the space of time between two laser pulses (for a repeating frequency of, for example, 200Hz) before the next laser pulse occurs.

This has the advantage of averaging out the granularity of the diffusion disk and furthermore that the granularity caused by the coherence of the laser radiation (speckle) is also averaged out. Note

This means that noise is reduced and an the image contrast is increased and that therefore image quality is improved.

For this, the magnitude of the rotating speed of the diffusion disk can lie in the easily realized range of approximately 1 rotation per second (a speed in the range of cm/s), so that for an assumed grain size of 0.1mm a displacement by at least the size of one grain takes place between two pulses.

Sub B2

The homogenizing effect is reinforced by a second diffusion disk rotating in the opposite direction.

Besides granulated diffusion disks (made by etching or abrasive blasting), holographic disks can also be used.

CGHs (computer-generated holograms) can also be used for homogenization.

While the foregoing description and drawings represent the present invention, it will be obvious to those skilled in the art that various changes may be made therein without departing from the true spirit and scope of the present invention.